Eye on the Sky

National Weather Service
Louisville, Kentucky

Summer 2000
Volume 1, Issue 2

A Newsletter for Emergency Mangers and Core Storm Spotters within our County Warning Area.

Bits From the Boss, A Final Farewell

After many years as an Air Force, Air National Guard, and National Weather Service meteorologist, I will be retiring from Federal service on June 3, 2000. Hence, this is a good time for me to offer my perspective on the changes in operational meteorology since 1964 when I began my forecasting career as a Second Lieutenant at Seymour Johnson Air Force Base in North Carolina. I analyzed surface and upper air charts, monitored the small round radar scope, scanned the pilot weather reports, briefed B-52 crews, prepared 24-hour Terminal Aerodrome Forecasts, and issued weather warnings. The numerical weather prediction models were very primitive in those days, lacking the complex physics and numerous vertical layers that are contained in current models. Of course, the computer systems in 1964 would probably have taken more than 24 hours to produce a 24-hour forecast using today's complex numerical models! Satellite technology was still very much in its infancy with the first satellite launches having been conducted in the late 1950s.

I still remember one very humbling experience as a Lieutenant: I briefed the Bomb Wing Commander and his staff at 3PM one afternoon to explain that snow would begin shortly and accumulate an inch or two before ending. An hour later the staff meeting was over and we walked outside to see 3 inches of snow on the ground, and the rest of the 8 inches wasn't far behind. It took quite awhile before the B-52 crews would let me forget that day!

Today when I look around our office with its state-of-the-art computer displays, it is truly amazing to me to consider the wealth of information available to NWS forecasters: timely, detailed

Marvin Maddox

satellite and Doppler radar displays, surface observations from automated networks, and an ever-increasing amount of numerical weather prediction model data from the National Centers for Environmental Prediction. The forecaster ponders this mountain of information and then decides "rain," "no rain," "rain changing to snow," or maybe just "pleasant and sunny today." The forecasting decisions are still basically the same as they were 36 years ago, but now there's much more information available to help the forecaster make the right decisions...and the forecasts are getting better.

Despite all the wealth of weather information, I notice that today's forecasters still share some common complaints with the forecasters from 1964. I still hear moans and groans concerning the lack of that one last piece of critical

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> Despite all of the technology we now possess, the storm spotter is still perhaps our greatest asset.

information when they get ready to prepare a tornado warning: “Are you sure that storm is really as strong as it looks on radar? That storm just passed over Y County and we haven’t received any reports of damage.”

Although forecasters often seem to be inundated with data, sometimes the mountain of data still doesn’t contain the crucial piece of information that they need for their warnings...and issuing warnings is still the most important job for operational weather forecasters. So, for the storm spotters and emergency managers reading this publication, remember that there may be a forecaster staring at the radar display in Louisville and bemoaning the lack of a spotter report from your location. If you have got something significant to report, don’t delay.

Thanks for all your help. Best wishes to everyone!

Marvin Maddox
Meteorologist In Charge

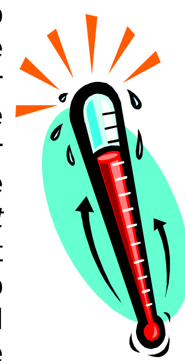
Summer Weather and the Heat Index

by Rob Cox
Forecaster

It’s that time of year to start thinking about how to prepare for the summer heat. Last year we experienced a very hot summer. In fact, Louisville’s average temperature in July was 81°F, which was about 4 degrees above normal. Louisville also had 17 days in a row with high temperatures of 90 degrees or above. Lexington tied for the 7th hottest July on record with an average temperature of 79.6°F, which also was about 4 degrees above normal. The highest temperature last July in Louisville was 104°F on the 30th with Lexington reaching 102°F on the same day. With these extremes, we need to all be aware of the dangers of heat as we approach Summer 2000.

Heat kills by wearing down the body beyond its abilities. Normally, the body dissipates heat by varying the rate and depth of blood circulation, by losing water through the skin and sweat glands, and as a last resort by panting when blood is heated above the normal body temperature. However, sweating will not cool the body unless the water is removed by evaporation. In the Ohio Valley, we often have a problem with high relative humidity during the summer which tends to retard evaporation and makes you feel uncomfortable.

The heat index (or apparent temperature) is a measure of how hot it feels when the effects of humidity are combined with the temperature. A heat index of 105°F is considered the level where many people begin to experience extreme discomfort or physical stress. The National Weather Service in Louisville will issue a *Heat Advisory* if the heat index is expected to reach or exceed 105°F for three hours or more during the day and the overnight index is expected to be around 80°F or higher. In extreme cases, the National Weather Service will issue an *Excessive Heat Warning* when the daytime heat index is expected to be 115°F or higher and the overnight index is 80°F or higher.



Eye on the Sky is a quarterly newsletter published by NWS Louisville for the benefit of the Emergency Managers and core spotters within our county warning area. We will include articles that provide useful seasonal information to you. Comments and suggestions are always welcome. Please email us at w-lmk.webmaster@noaa.gov.

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Ted Funk and Van DeWald
Chief Editors

When an advisory or warning is issued for your area this summer, here are some heat disorder symptoms that you should watch out for if outdoors for prolonged periods of time.

Disorder	**Symptoms**
Sunburn	Redness and pain. In severe cases, swelling of skin, blisters, fever, and headaches.
Heat Cramps	Painful spasms usually in muscles of legs and abdomen. Heavy sweating.
Heat Exhaustion	Heavy sweating, weakness, skin cold, pale and clammy. Pulse weak. Normal body temperature possible. Fainting and vomiting possible.
Heat Stroke	High body temperature (106°F or higher). Hot dry skin. Rapid and strong pulse. Possible unconsciousness.

Heat Wave Safety Tips

*Slow down***.** Strenuous activities should be reduced, eliminated, or rescheduled to the coolest time of the day.

Dress for summer. Wear lightweight, light-colored clothing that reflects sunlight.

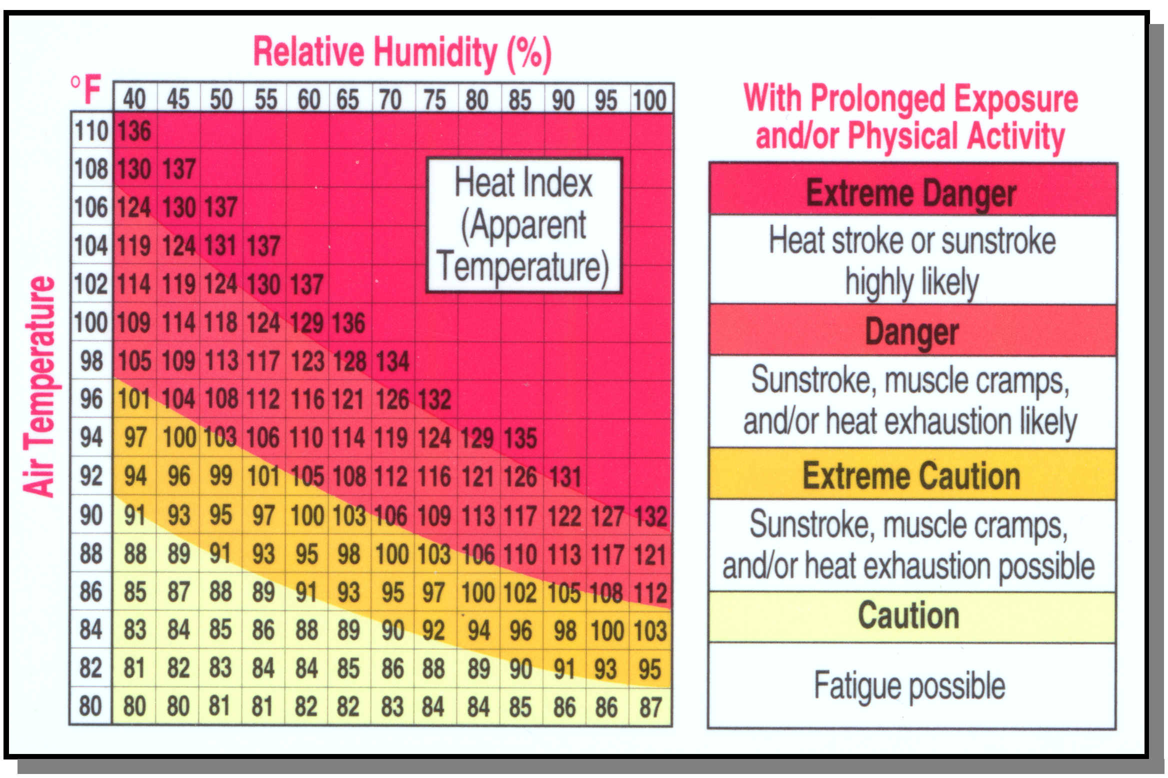
Eat small meals more often. Foods like proteins increase the metabolic heat production and increase water loss.

Drink plenty of water or other non-alcoholic beverages. Your body needs fluids to keep cool. Drink plenty of liquids even if you are not thirsty.

Don't get too much sun. Sunburns make the job of heat loss much more difficult.

Spend more time in cooler areas. If you move out of the direct sunlight, heat indices can be as much as 15°F lower. If possible, move to an air-conditioned area or if you cannot afford an air conditioner, use electric fans to circulate the air.

Check on the elderly, very young, and pets. They can be especially susceptible to the extreme heat.



°F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

AWIPS Technology Leads NWS into New Millennium

by Ted Funk
Science and Operations Officer

A high-speed technologically-advanced processing, display, and telecommunication network called the Advanced Weather Interactive Processing System (AWIPS) is the centerpiece of the modernization of the National Weather Service (NWS). AWIPS is an interactive computer system that integrates all meteorological, hydrological, satellite, and radar data for the first time into one computer workstation. Previously, these data sets were available from different computer systems. AWIPS also allows forecasters the interactive capability to view, analyze, combine, and manipulate large amounts of graphical and alphanumeric weather data like never before. Thus, AWIPS provides a much more efficient and effective means for forecasters to prepare and issue more accurate and timely forecasts and warnings. AWIPS has been installed in all 119 modernized Weather Forecast Offices (WFOs), 13 regional River Forecast Centers (RFCs), and several national weather centers. AWIPS was installed at NWS Louisville in July 1998, but is upgraded periodically with new and improved software and hardware to further enhance the forecast and warning process.

AWIPS ingests and processes the following primary data sets:

1. Numerical computer model forecast data from several models.
2. WSR-88D Doppler Radar data.
3. GOES satellite data, including visible, infrared, and water vapor satellite imagery.
4. Observed surface data from Automated Surface Observing Systems (ASOS) sites.
5. Observed upper-air and sounding data from radiosonde sites.
6. Hydrologic data and programs, such as river gauges, river levels, and forecasts.
7. Various forecast guidance products from the National Centers for Environmental Prediction (NCEP), National Hurricane Center (NHC), and Storm Prediction Center (SPC).
8. Various applications programs and other data sets.

The AWIPS system architectural design is driven by expandability, flexibility, availability, and portability. The system is easily expandable to allow for the introduction of new functionality and the addition of network and processing capabilities. AWIPS is designed so that software and data can be transferred to new platforms as technology evolves. The system architecture consists of the Network Control Facility (NCF) in Washington, DC, satellite broadcast network (SBN), wide area network (WAN), Weather Forecast Offices (WFOs), River Forecast Centers (RFCs), National Centers, and the NOAAPORT Receive System (NRS). The SBN is a key component of the AWIPS communication network that distributes large amounts of data from the NCF to each AWIPS site (WFOs and RFCs) through satellite communication. AWIPS also consists of a wide area network (WAN), a high speed data network of terrestrial communications lines, which allows communications among AWIPS sites.

Key hardware components of AWIPS at each field weather office include the downlink antenna that receives transmitted data; several communication, application, and data processors and servers to ingest, translate, create, manipulate, and store data; the Local Data Acquisition and Dissemination System (LDADS); and several forecaster workstations, each consisting of one text and two graphical monitors.

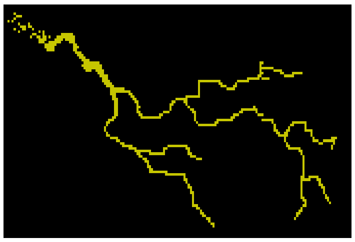

The downlink antenna at NWS Louisville which ingests several gigabytes of data each day.


A forecaster workstation consisting of one alphanumeric and two graphical consoles. There are a total of five individual workstations in the Louisville Office.

Heat and Humidity Help Spawn Nature's Fireworks in the Summer

By Don Kirkpatrick
Senior Forecaster

Thunderstorms are common in spring and summer when moisture, unstable air, and lift most often coincide. Unstable warm, moist air that is forced upward by a front or other lifting mechanism forms clouds, rain, and ultimately thunderstorms. All thunderstorms produce lightning, which kills more people each year than tornadoes. Thunderstorms with heavy rain may lead to flash flooding, which is the number one weather-related killer across the United States each year with about 140 fatalities. Other thunderstorm hazards may include damaging winds, large hail, and tornadoes, which are most likely in spring, i.e., from April to June.



Lightning results from the buildup and discharge of electrical energy between negative and positive charged areas which are separated within the storm by rising and descending air. Thunder within a storm is caused by rapid heating of air near the lightning channel, resulting in a shock wave.

Most lightning occurs within the cloud or between the cloud and ground. Cloud-to-ground lightning starts as an invisible channel of electrically charged air moving from the cloud toward the ground. When one downward channel nears an object, a powerful surge of electricity from the ground *rises* to the cloud and produces the visible lightning strike.

The air near a lightning strike is heated to 50,000°F (*hotter than the surface of the sun).* Most lightning casualties occur when people are outdoors in the summer during the afternoon and early evening. Many lightning fatalities are related to water sports but others have occurred to people standing under a tree or talking on the telephone.

To provide the utmost lightning protection, myths must be separated from facts. These are the facts:

- Rubber-soled shoes and rubber tires provide no protection from lightning. The steel frame of a hard topped vehicle provides increased protection if you are not touching metal.
- Lightning often strikes outside of heavy rain and may occur as far as 10 miles away. If you can hear thunder, you are close enough to the storm to be struck by lightning.
- People struck by lightning do not carry an electrical charge. They need immediate attention!
- Night-time *heat lightning* is actually lightning from a distant thunderstorm. The storm is too far away to hear the thunder.
- Telephone lines and metal pipes can conduct electricity. Avoid using electrical appliances or telephones during a storm and stay out of the bath or shower.

Follow these lightning safety rules if caught outside with no shelter nearby:

- Find a low spot away from tall trees, fences, and poles.
- If your hair stands on end or your skin tingles, squat low to the ground on the balls of your feet and place your hands on your knees with your head between them. Make yourself the smallest target possible and minimize your contact with the ground.

Other Thunderstorm Descendants

While all thunderstorms produce lightning, only severe storms produce tornadoes, large hail and damaging winds. The National Weather Service labels a thunderstorm severe if it produces at least one of the following phenomena:

- Tornado
- Wind 58 mph (50 knots) or higher
- Hail 3/4" in diameter or larger

Of all the thunderstorms that occur over the United States, only about 10 percent are classified as severe. In summer, the dominant type of severe thunderstorm across the Lower Ohio Valley is the *Pulse Severe*

Storm which feeds off moist, unstable air and may inflict damage rather quickly. A severe pulse storm will likely produce localized damaging winds at the ground due to wet downbursts. These downbursts can cause damage equivalent to a moderate (F1) tornado. The pulse storm also will likely produce brief torrential rains and possibly large hail.

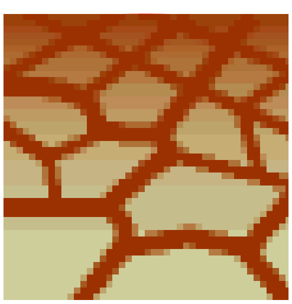
While severe storms are most common in spring, thunderstorms in general are most numerous over Kentucky and southern Indiana during the summer season. When thunderstorms draw near, stay informed by listening to NOAA Weather Radio, commercial radio, or TV for the latest watches and warnings from the National Weather Service.

We are committed to becoming America's no surprise National Weather Service. We are a world class team of professionals and technicians who:

1. Produce and deliver quality warnings and forecasts you can trust when you need them the most.
2. Use cutting edge techniques.
3. Provide services in a cost effective and efficient manner.
4. Strive to eliminate weather-related fatalities and improve the economic value of weather information.

No matter what the weather, rain or shine, thunderstorms or tornadoes, we're always ready to provide the most consistent forecast and warning service possible!

The National Weather Service Drought Program



by Mike Callahan
Service Hydrologist

In the previous issue of this newsletter, we talked about the flood warning program of the National Weather Service. In this issue, we will discuss the opposite of floods, i.e., drought, something that is quite familiar to many of us.

Drought means different things to different people and there are different types of drought. Unlike floods, drought develops over several weeks or months and can take that long to end. Drought can even last for more than a year. A prolonged drought can be just as costly as a major flood.

The basic definition of drought is a prolonged period of below normal precipitation. However, this definition leaves two questions unanswered: how long a period and how large a deficit?

Droughts usually can be classified as short-term agricultural, or long-term water supply. Agricultural droughts develop after several weeks of little or no rainfall. Shallow rooted crops are the first to show stress, but then later, deep rooted crops begin to wither.

It is rather easy to tell if an agricultural drought exists just by looking at plants. Fortunately, agricultural droughts can end soon if rain begins to fall before harvest time. However, the rains should not be too heavy as it is possible to have a flood in the middle of a drought. If the rain is too intense, it will run off and not soak into the ground.

Water supply droughts are caused by several months of below normal precipitation. After a couple of dry months, groundwater levels begin to fall. After awhile, river levels are very low and small streams even disappear. Sometimes, water supply droughts can be misleading because just enough rain may occur to keep the grass green. However, one can tell if a water supply drought exists by watching how fast a stream falls after a rain. The water that keeps a small stream running well after the rain falls is the groundwater. During a water supply drought, wells can go dry and communities that depend on small streams for water supply can run out of water. If an agricultural drought is also ongoing, water demand can exceed the municipal system's capacity due to lawn watering and vehicle washing which compounds the problem.

The National Weather Service has developed a drought index called the Palmer Drought Severity Index in order to classify long-term droughts. This index is updated every week. We also make long range forecasts of both temperature and precipitation to give water supply planners a chance to prepare for droughts. The National Weather Service is an active member on state drought advisory groups which keep state governors informed, in case emergency restrictions are needed.

By the way, at press time, the entire state of Kentucky, according to the Palmer Index, was still in a moderate long-term drought caused by the hot, dry summer and fall of last year. Conditions are somewhat better across south-central Indiana. The outlook for the upcoming summer and early fall again is drier and hotter than normal. So it looks like we will again experience drought conditions during the upcoming months. Let's hope it will not be as bad as last summer's which was the worst since 1954.

Tropical Systems in the Ohio Valley?

by Anthony Sturey
Senior Forecaster

Unless you are planning a trip to the Atlantic shore, the Gulf Coast region, or the many islands in the Carribean, the thought of a tropical weather system affecting you may be the wildest thought in your mind. But it can happen, as the remnants of tropical weather systems can work their way into the Ohio Valley causing severe weather and torrential rain.

The National Hurricane Center (NHC) in Coral Gables, Florida is tasked with maintaining a continuous weather watch on tropical weather systems over the Atlantic, Gulf of Mexico, Carribean, and the Eastern Pacific. The Atlantic hurricane season runs from June 1st through November 30th. The peak hurricane months are August and September.

The term "hurricane" is a regionally specific name for a strong tropical cyclone. A tropical cyclone is the generic term for a non-frontal synoptic scale low pressure system over tropical waters, with organized thunderstorm activity and a definite counterclockwise (cyclonic) circulation. Tropical cyclones with sustained winds of 39-73 mph are classified as "tropical storms." Tropical cyclones with winds 74 mph or greater are classified as "hurricanes."

Tropical cyclones are fed by warm ocean waters, usually 80°F or higher. As a result, once tropical systems make landfall, they weaken and gradually take on characteristics of low pressure systems more common in these latitudes. The location of landfall, speed, and intensity of the tropical cyclone are important too this discussion.

As a general rule of thumb, tropical systems making landfall along the Eastern Seaboard do not pose a problem for central Kentucky or south-central Indiana, as the Appalachian mountains act as a barrier and steer the systems to the north. (Remember, low pressure systems like to take the path of least resistance and not cross mountains). Tropical systems making landfall from Texas to Alabama are the ones we have to watch closely. If steering mechanisms are favorable, they could move north toward the Tennessee and Ohio Valleys.

The forward speed of a tropical cyclone is very important. If the remnants of a decayed tropical cyclone (extra-tropical low) moved slowly into the Tennessee and Ohio Valleys, then our awareness for the possibility of torrential rain and flash flooding would be heightened. Normally during the daytime, heavy rain from one of these extra-tropical low pressure systems is rather expansive. However, at night the heavy rain area constricts to near the center of the low. It is during the night and near the center of the low pressure system that some rather impressive rainfall totals may be observed.

On the other hand, fast moving tropical systems pose additional problems. The greatest threat for tornado production occurs prior to and during the time of landfall for intense hurricanes. If the forward speed is fast, then the remnants of tropical systems reaching the Ohio and Tennessee Valleys pose a threat for severe weather in our area. This is because higher wind fields will be maintained for a faster moving system on its trek north.

Names are assigned for all tropical cyclones that reach tropical storm strength or greater. Here is the list of the names for the 2000 Atlantic hurricane season:

Alberto, Beryl, Chris, Debby, Ernesto, Florence, Gordon, Helene, Isaac, Joyce, Keith, Leslie, Michael, Nadine, Oscar, Patty, Rafael, Sandy, Tony, Valerie, and William.

Kentucky Severe Storms Preparedness Committee

by Norm Reitmeyer
Warning Coordination Meteorologist

The challenge of protecting life and property is one the National Weather Service shares with numerous government and public service agencies across Kentucky.

The National Weather Service, Kentucky Division of Emergency Management, Kentucky State Police, Kentucky Broadcasters Association, the Kentucky Network, Kentucky Cable Television Association, Kentucky Department of Education, and American Red Cross comprise the Kentucky Severe Storms Preparedness Committee. The Chairman of the Committee is Patrick C. Conley, Public Information Officer for the Kentucky Division of Emergency Management. The State Farm Insurance Company has also partnered with the Committee in several projects in recent years.

The focal point of the program is the annual Kentucky Severe Storms Preparedness Month in March. A practice Tornado Drill is conducted to give schools, hospitals, businesses, organizations of all sorts, and individuals a chance to practice what they would do in the event of a tornado.

The Committee, which meets monthly from September to February, also coordinates with television meteorologists. Recently, call-in programs have been aired on KET and booths have been set up at Lexington area locations to heighten awareness of how to respond during severe weather.

Each year the Severe Storms Preparedness Committee oversees production of the Severe Storms Preparedness Guide. The Guide, produced by the Kentucky Division of Emergency Management, contains up-to-date statistics and other preparedness information vital to emergency managers and others involved in helping citizens to withstand the assaults of tornadoes, damaging winds, large hail, and flash floods.

Each campaign is assigned a theme, which emphasizes a certain facet of severe weather. This past year the theme was “Storm Prep 2000: Alerting Kentucky to Weather Dangers.” This theme stressed the varied elements of the warning system across Kentucky. The Kentucky Severe Storms Preparedness Committee is seeking to unite several organizations in meeting the goal of protecting life and property from the incursions of severe weather.

A Look at the Past and Future

by Larry Dattilo
Data Acquisition Program Manager

Now that winter has passed, it is time to start thinking about what lies ahead for the coming months. The year 1999 started out wet and warm throughout the winter months, then turned hot and dry for the summer. Summer 1999 ultimately became one of the worst drought periods that the region has experienced in quite a few years. So let’s review to see how Winter 1999-2000 unfolded for major cities in your area!

Coldest Temperature of Winter 1999-2000		Snowfall this Season
Louisville, Kentucky	2°F on December 25, 1999	11.2 inches
Lexington, Kentucky	2°F on December 25, 1999	5.2 inches
Bowling Green, Kentucky	11°F on January 25 and 27, 2000	1.3 inches

Average Temperature/Departure from Normal (°F)

	December 1999	January 2000	February 2000	March 2000	April 2000
Louisville	38.1/+1.4	33.7/+2.0	44.2/+8.5	50.1/+3.8	54.7/-1.6
Lexington	37.3/+1.4	31.9/+1.1	42.7/+8.2	48.3/+3.0	53.3/-1.5
Bowling Green	40.7/+2.9	35.8/+2.9	44.5/+7.3	50.1/+2.7	55.2/-1.8

Precipitation/Departure from Normal (inches)

	December 1999	January 2000	February 2000	March 2000	April 2000
Louisville	5.64/+2.00	5.51/+2.65	6.62/+3.18	3.59/-1.07	3.54/-0.69
Lexington	2.70/-1.28	3.40/+0.54	4.81/+1.60	3.89/-0.51	4.52/+0.64
Bowling Green	4.06/-0.97	3.04/-0.78	3.44/-0.69	2.71/-2.39	4.87/+0.55

Now what does the forecast have in store for us this summer? The forecasters at the Climate Prediction Center say that the summer will again have above normal temperatures and below normal rainfall. Only time will tell!

Astronomical Calendar (Times in EDT)

	New Moon	First Quarter	Full Moon	Last Quarter
June	Jun 2, 814 AM	Jun 8, 1129 PM	Jun 16, 627 PM	Jun 24, 900 PM
July	Jul 1, 320 PM	Jul 8, 853 AM	Jul 16, 955 AM	Jul 24, 702 AM
August	Jul 30, 1025 PM	Aug 6, 902 PM	Aug 15, 113 AM	Aug 22, 251 PM

Summer Solstice: June 20, 948 AM
Earth's Apogee (farthest from Sun): July 3, 800 PM

Newsletter Feedback

Now that we've completed the second edition of our Newsletter, ***Eye on the Sky***, we'd like to hear a few comments from our readers. In each quarterly issue, we've tried to concentrate on the weather phenomena that are expected in the coming months. For example, in this issue, we discussed topics such as summer weather, the heat index, AWIPS, drought, the beginning of hurricane season, etc. In our next issue, due September 1, we'll present articles related to the fall season, such as the first frost or freeze, ColorFall forecasts, and so forth.

Are there other topics you'd like us to discuss? What do *you* feel should be included in each quarterly edition of our ***Eye on the Sky*** newsletter? Do you find this publication helpful? Is the information provided useful and pertinent? We'd very much appreciate hearing from you! If you have Internet access, please take a couple of moments to fill out our customer survey at **http://www.crh.noaa.gov/lmk/newsletter_survey.htm**. Otherwise, please drop us a note in the mail (our address is located near the front of the newsletter) to let us know how we're doing. Thank You.

Regards,
The Newsletter Team

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